What to show in the white paper - F_L, F_2

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What do we do with F_2, F_L?

- Initially, it was thought that F_L was a golden measurement in e+A collisions and would discriminate between saturation and non-saturation effects

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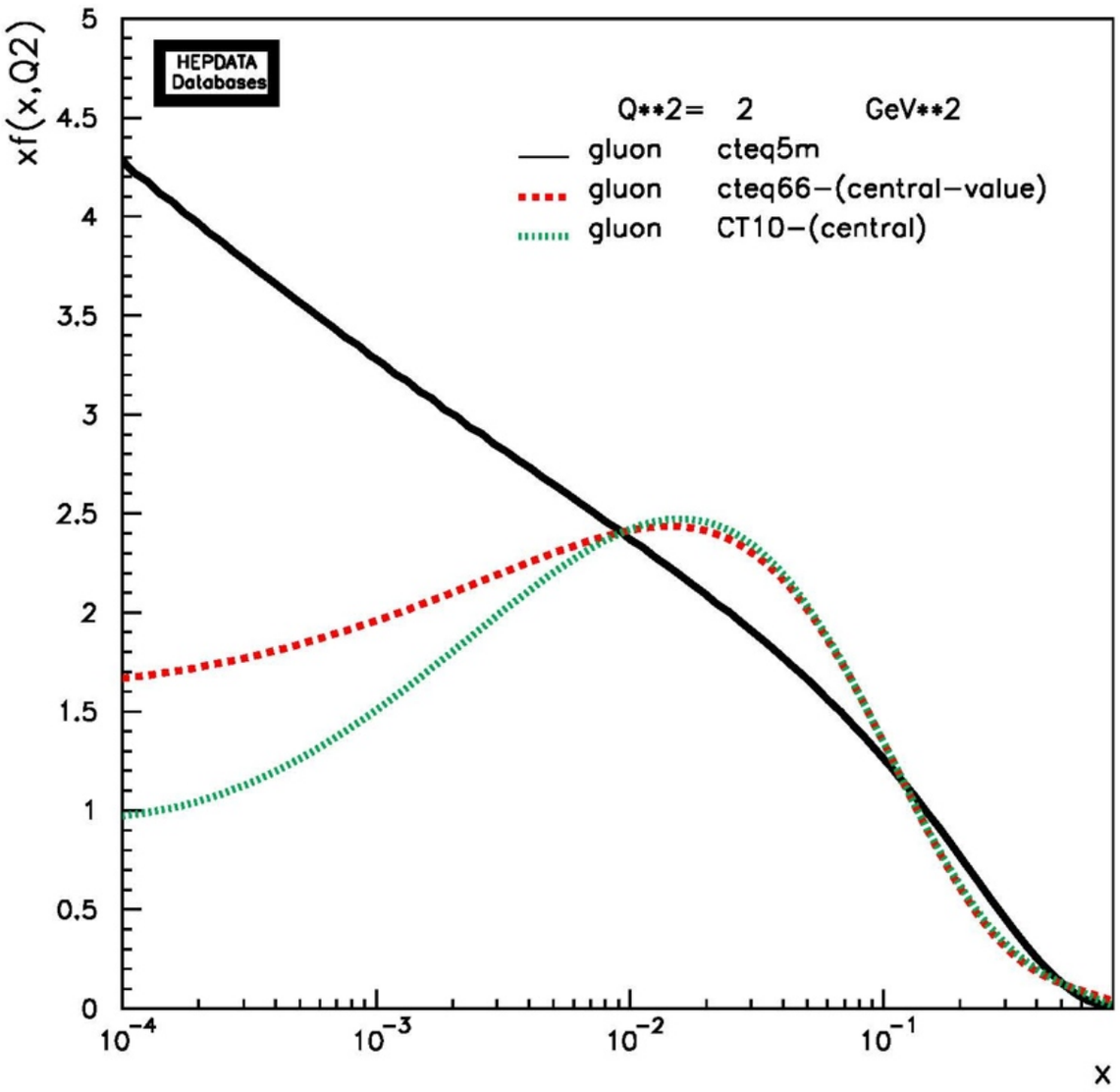
- Initially, it was thought that F_L was a golden measurement in e+A collisions and would discriminate between saturation and non-saturation effects
- Then came the model predictions….
- Many model predictions were previously shown from:
  - ➡ Leading-twist shadowing
    - ▸ FGS’10 - Frankfurt, Guzey, Strikman
  - ➡ Saturation
    - ▸ IPSat/bCGC - Raju, Lappi, Henri ….
    - ▸ rcBK - Albacete, Paloma ….

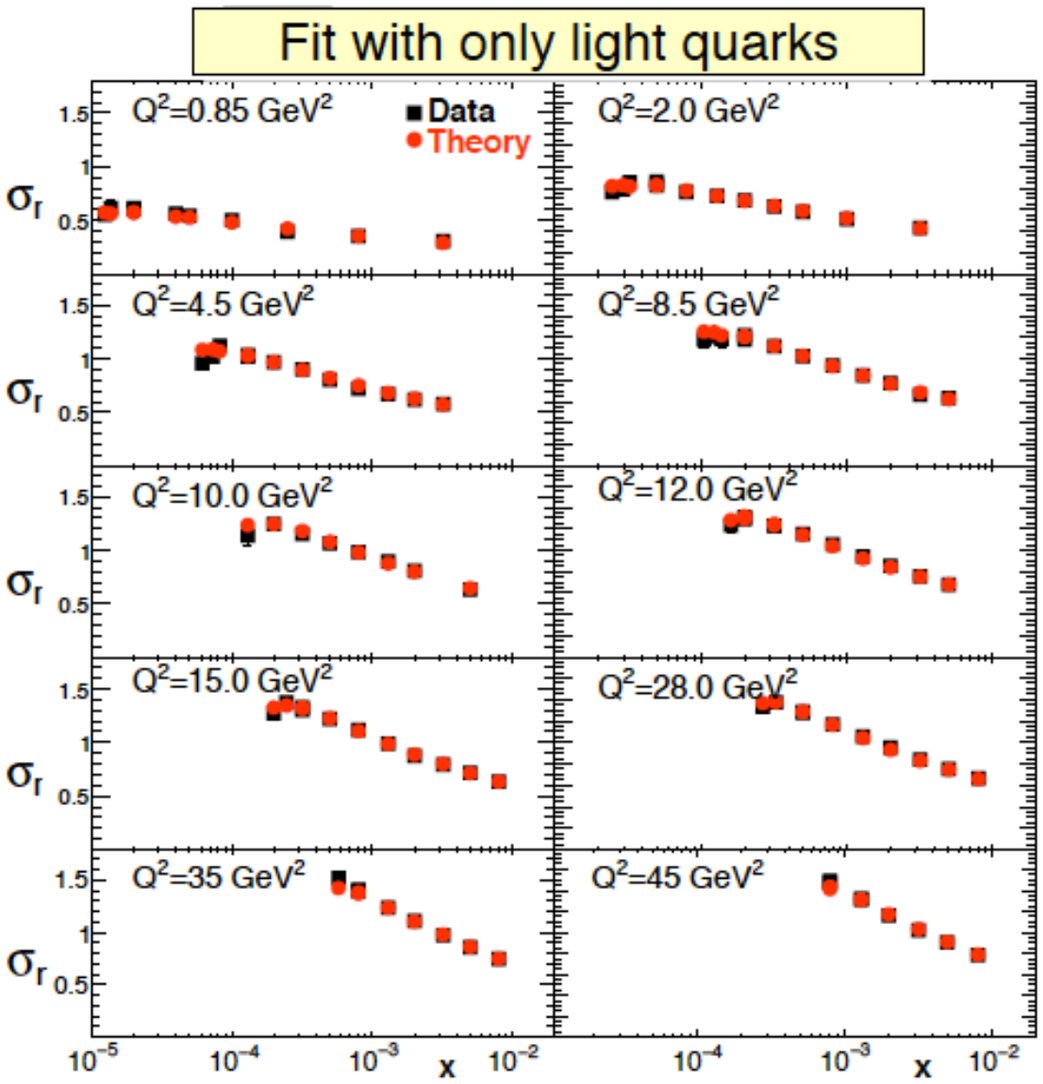
Leading-Twist Shadowing (FGS)

- Model is not a saturation model but creates saturation-like effects by hand.
- Does not reproduce the proton F_2 and F_L data
  - ➡ Uses decade-old CTEQ PDFs?



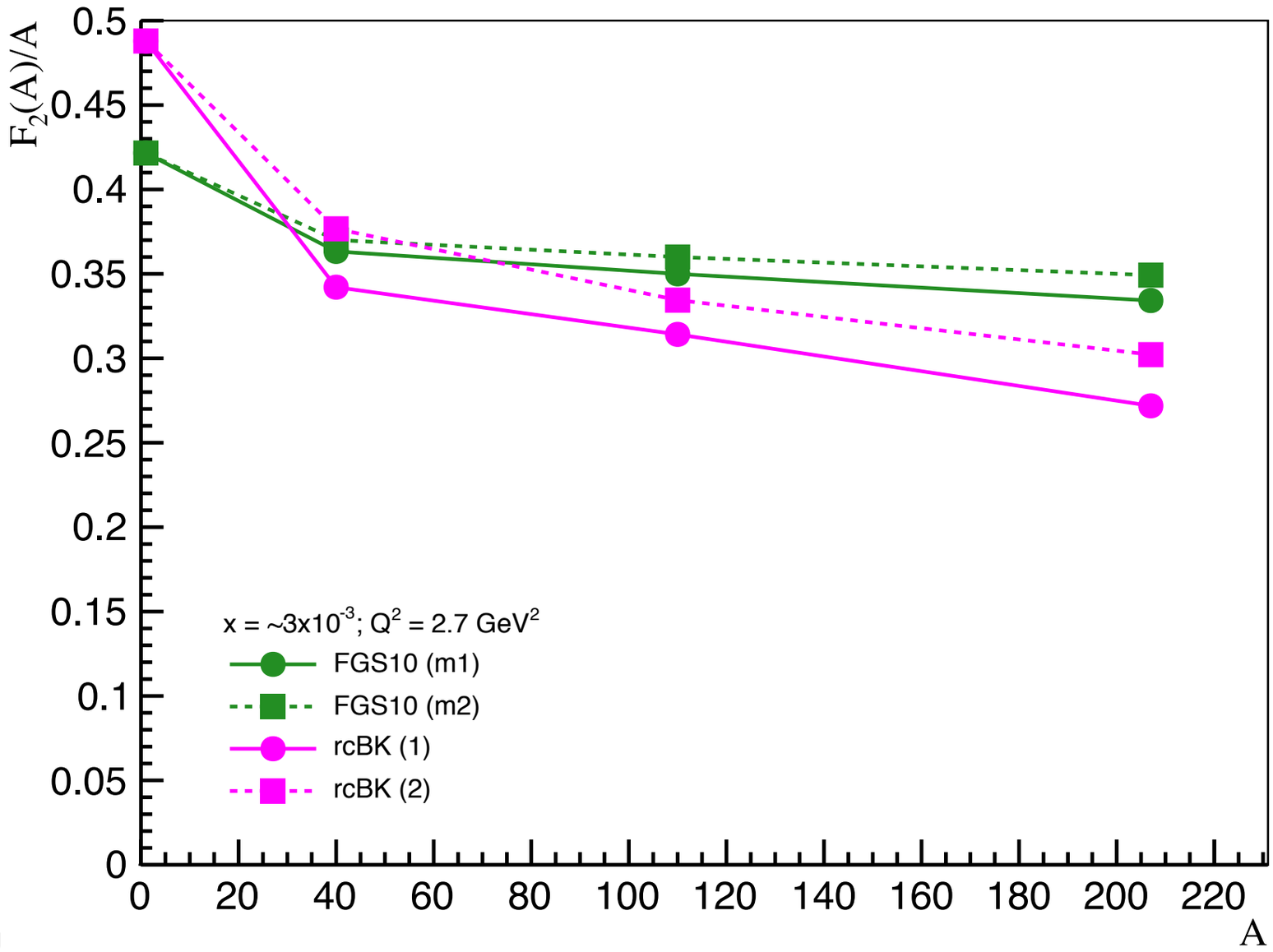
Shadowing models

- IPSat/bCGC
  - ➡ Not fit to most recent data
- rcBK
  - ➡ Fit to most recent data, describes data very well, most theoretically sound saturation model. Implementing running-coupling effects addresses higher-order effects



How to represent F_L and F_2 in the White paper?

- Idea - linear and non-linear effects should have different dependences on A



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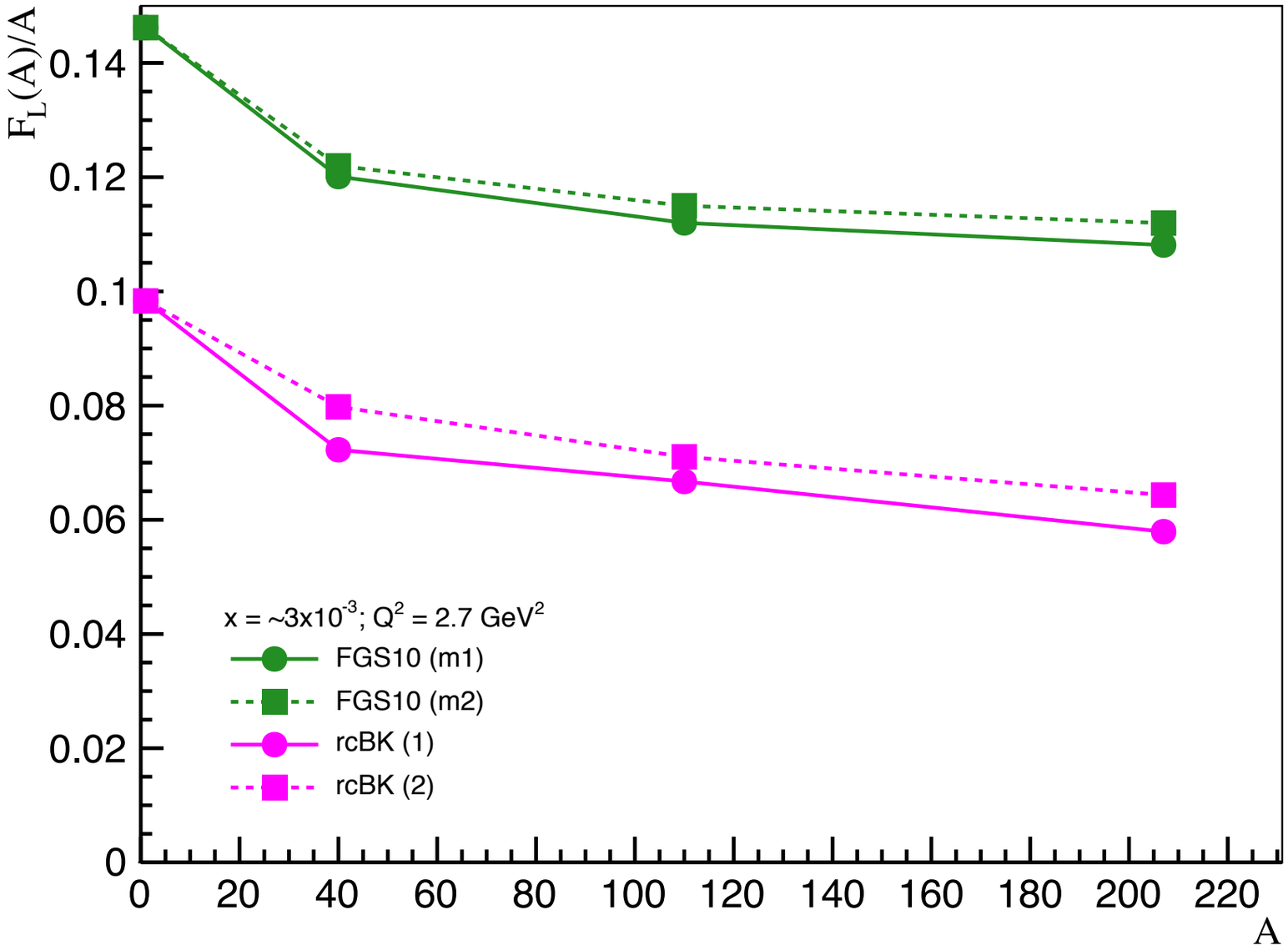


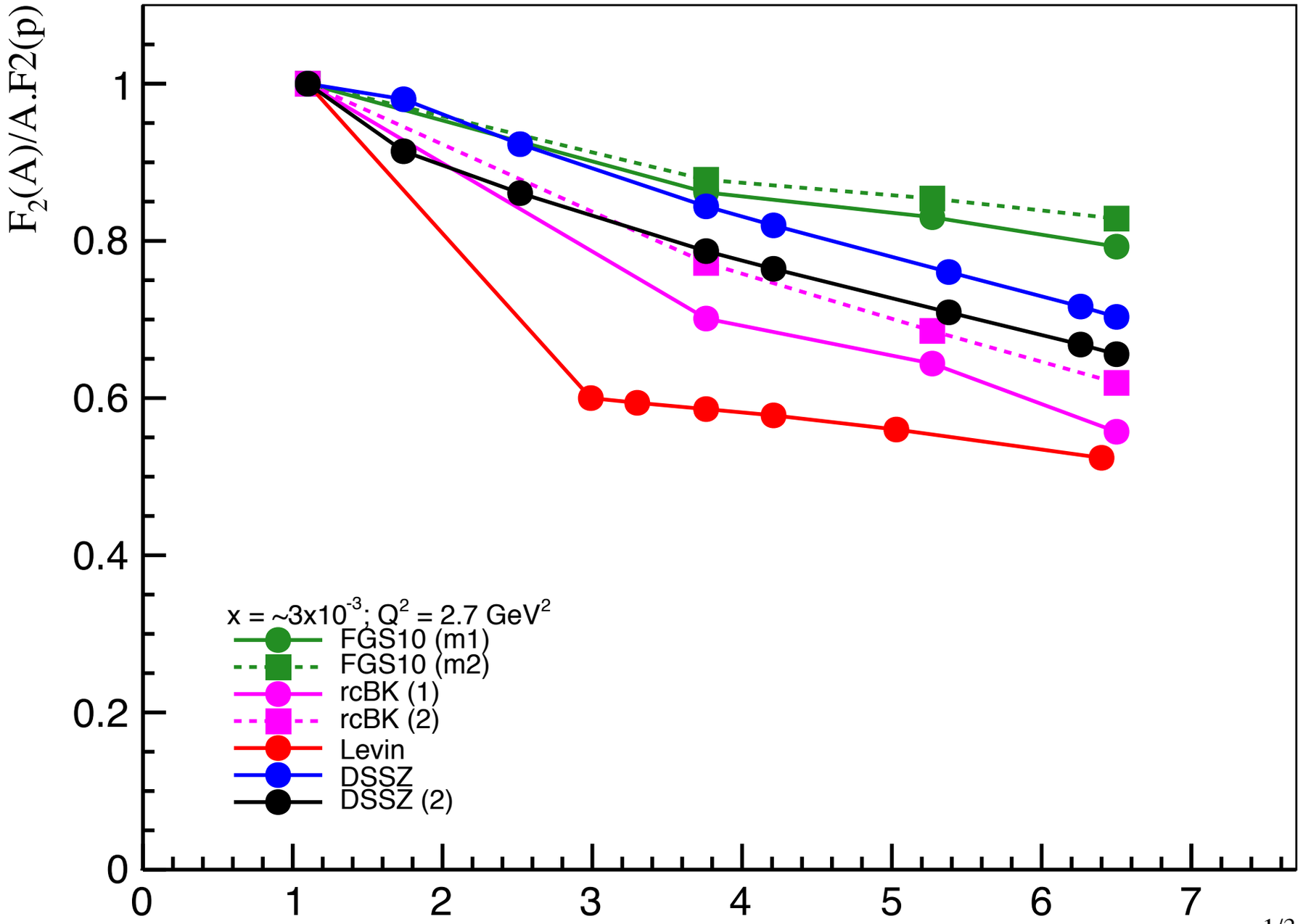
How to represent F_L and F_2 in the White paper?

- FGS model is so far off in the proton, can't use this. Not ideal in any case to represent non-saturation effects.
- Use DSSZ (NLO pQCD calculation)

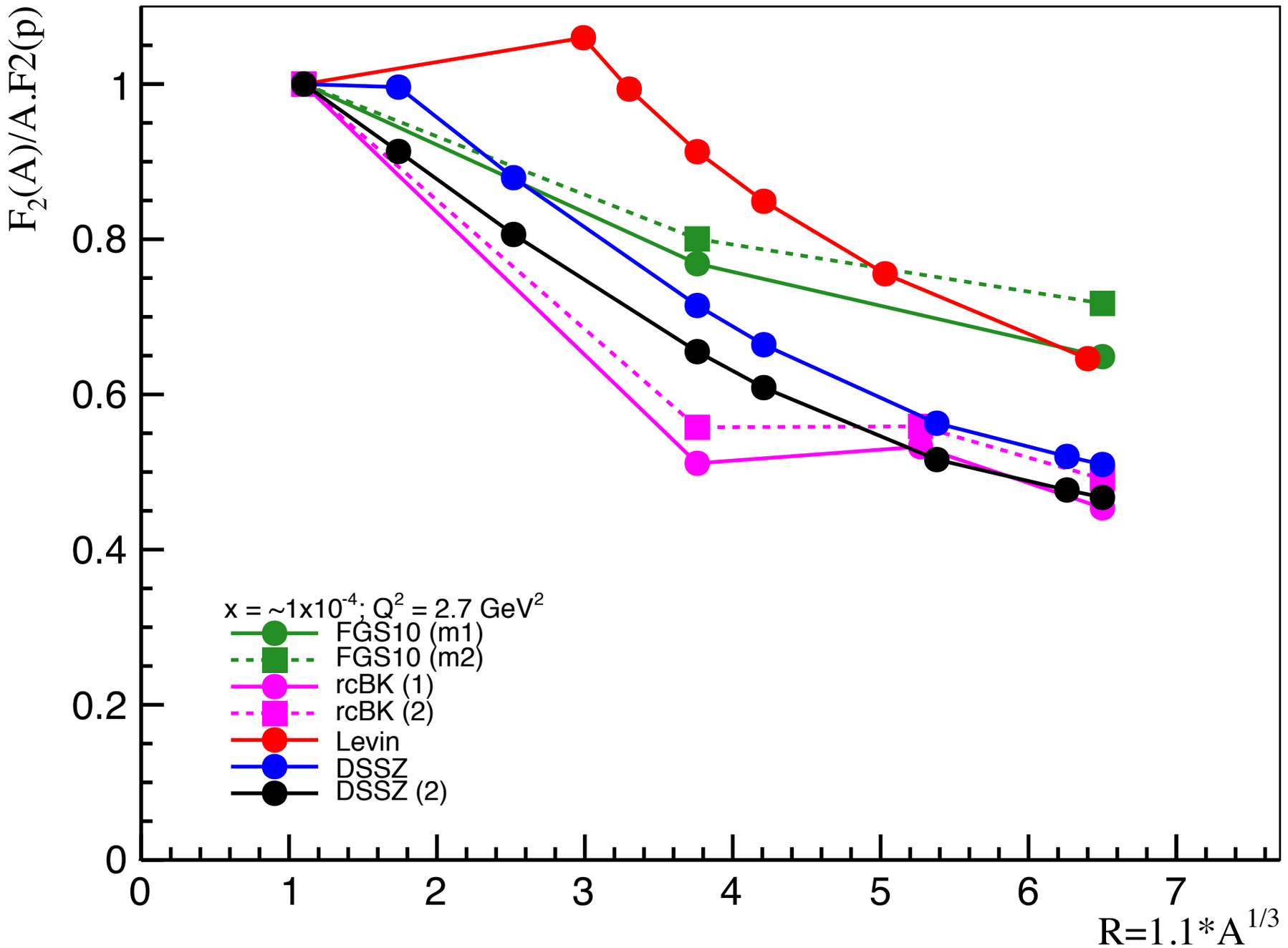
  ➡ Uses MSTW for the proton PDFs and then performs an analysis on:

  - DIS of charged leptons on nuclei
  - Drell-Yan di-lepton production
  - neutrino-nucleus scattering
  - inclusive pion production in d+A collisions

DSSZ vs rcBK


$F_2(A)/A.F2(p)$
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
6
7
$R=1.1*A^{1/3}$
x = ~3x10^{-3}; Q^2 = 2.7 GeV^2
FGS10 (m1)
FGS10 (m2)
rcBK (1)
rcBK (2)
Levin
DSSZ
DSSZ (2)

DSSZ vs rcBK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FGS10 (m1)
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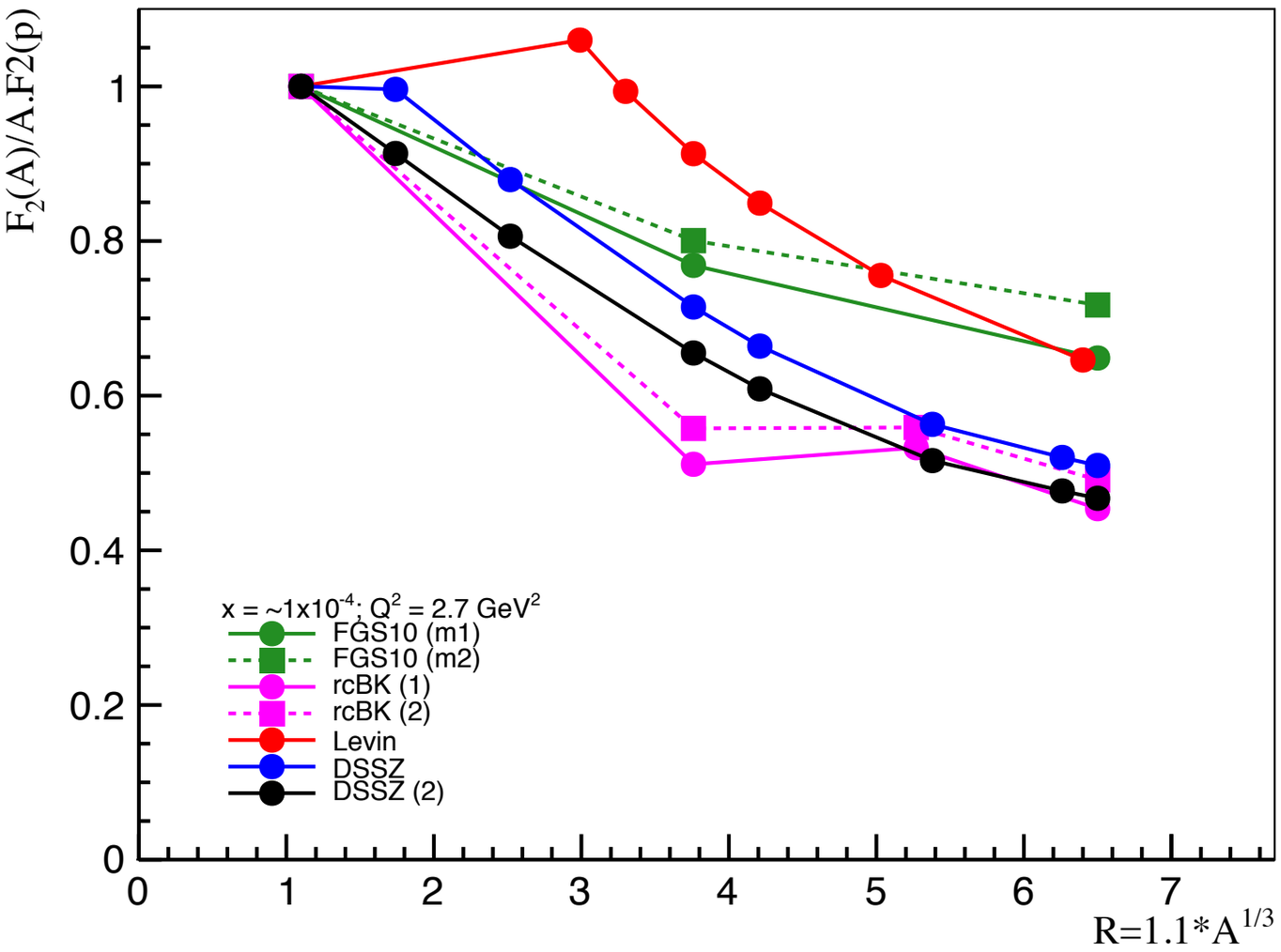
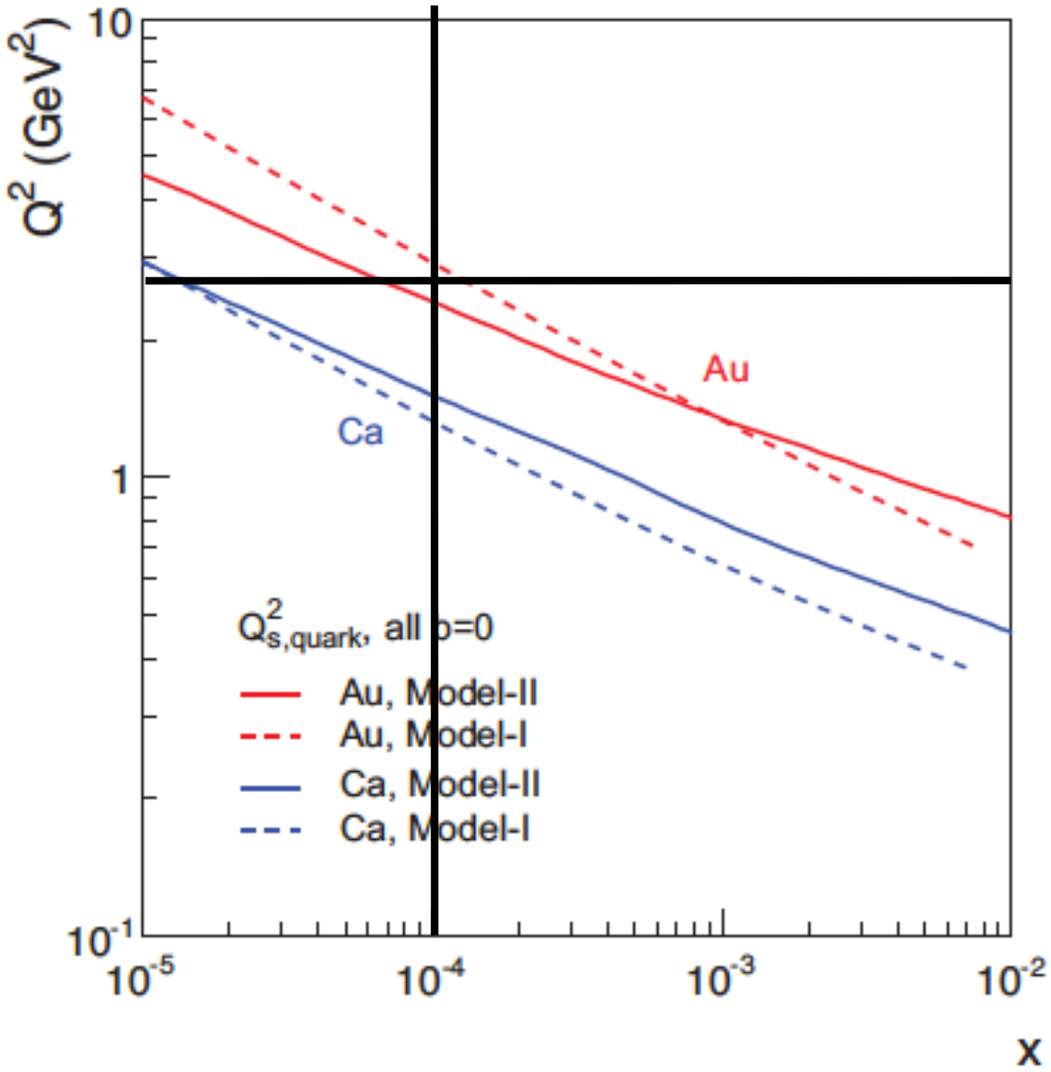
rcBK (1)
rcBK (2)
Levin
DSSZ
DSSZ (2)

Why so little difference between DSSZ and rcBK?

- Are we still just to high in Q^2 to see anything?
  - ➡ I have Q^2 = 0.5, 0.85, 1.20, 2.0 from rcBK...





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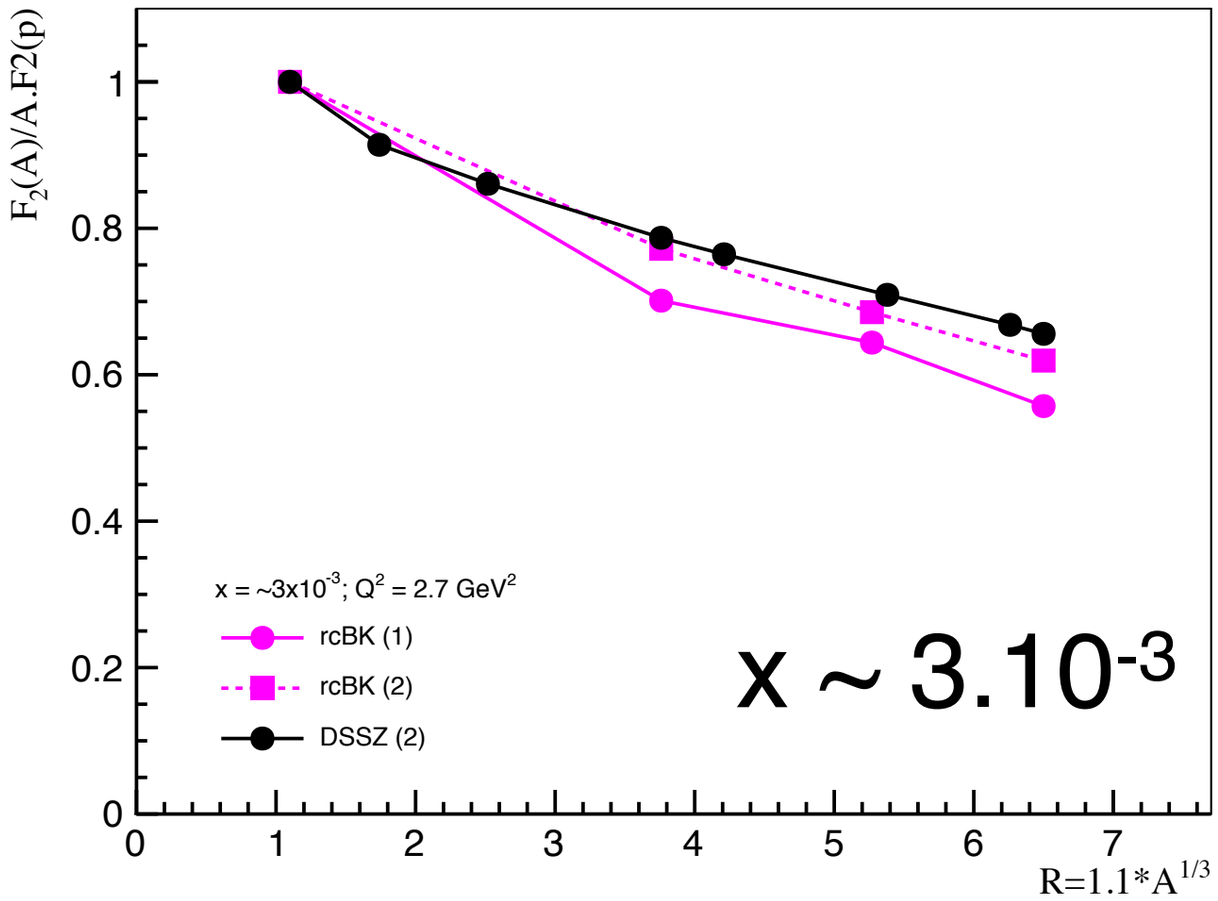
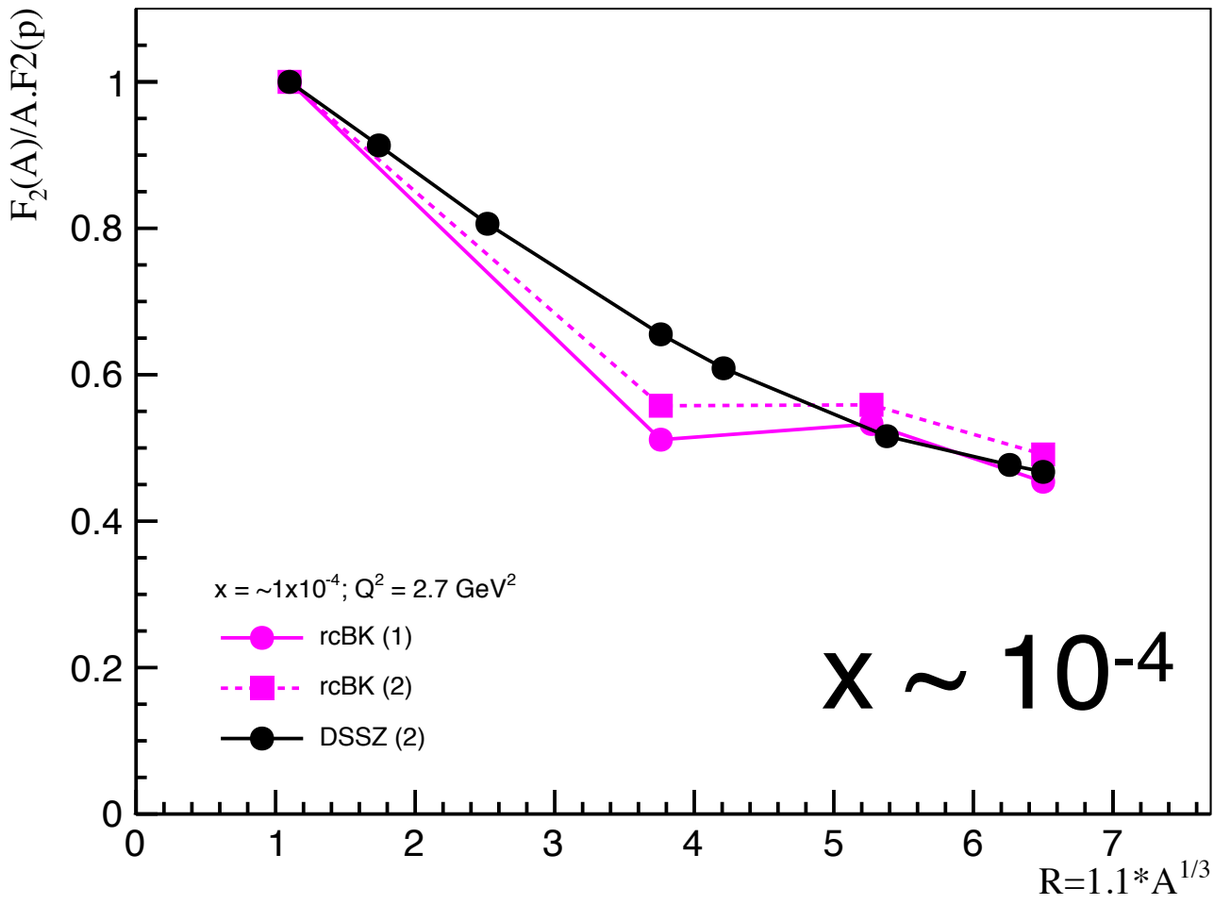
What's left to do?

- Look at lower Q^2
- Make plots for F_L - is that where the difference lies?





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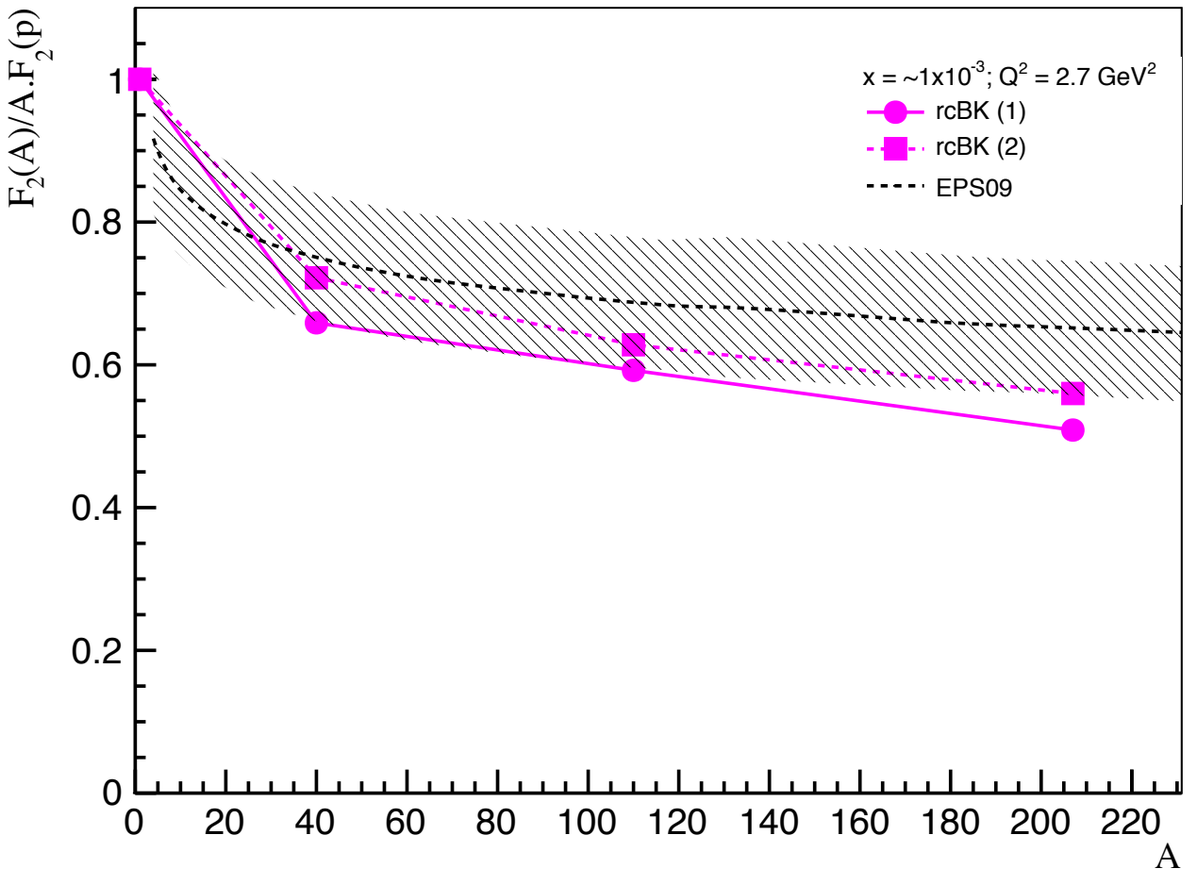
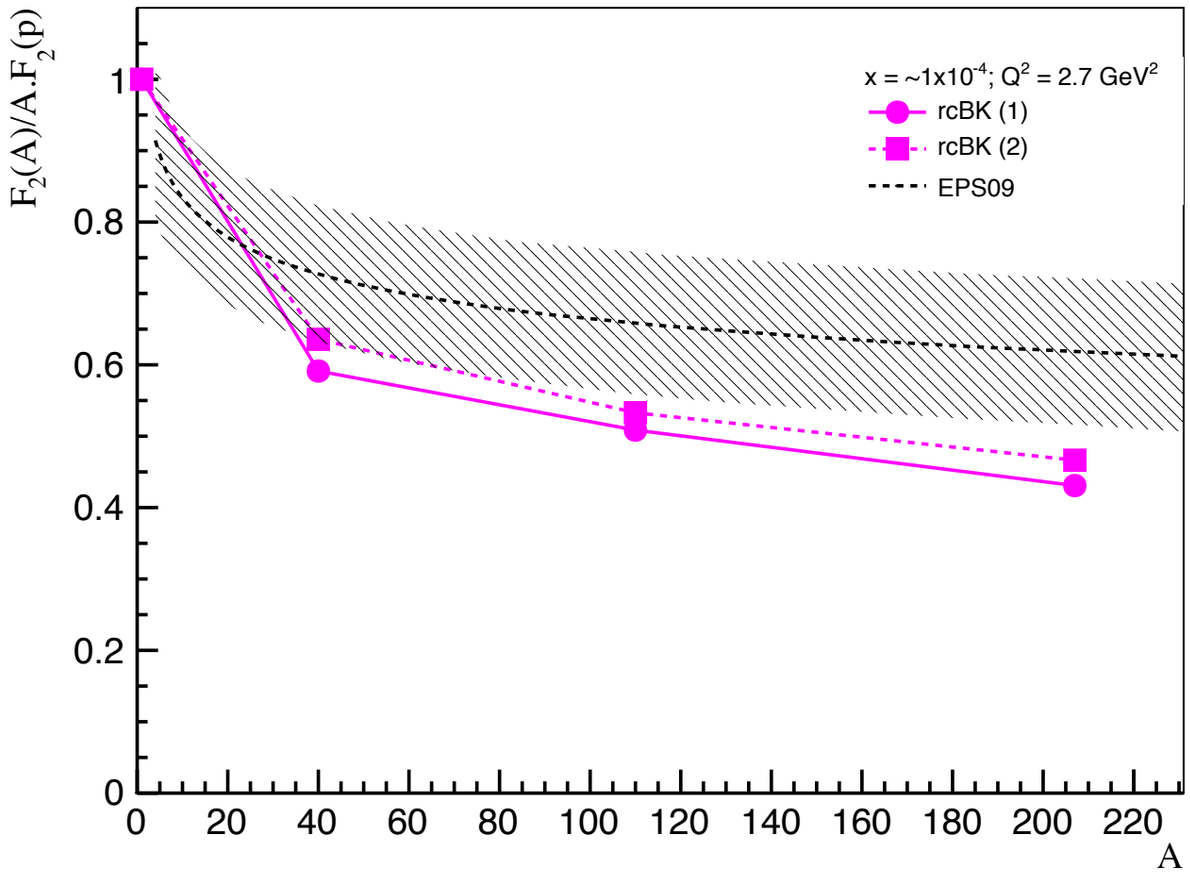
EPS09 and rcBK

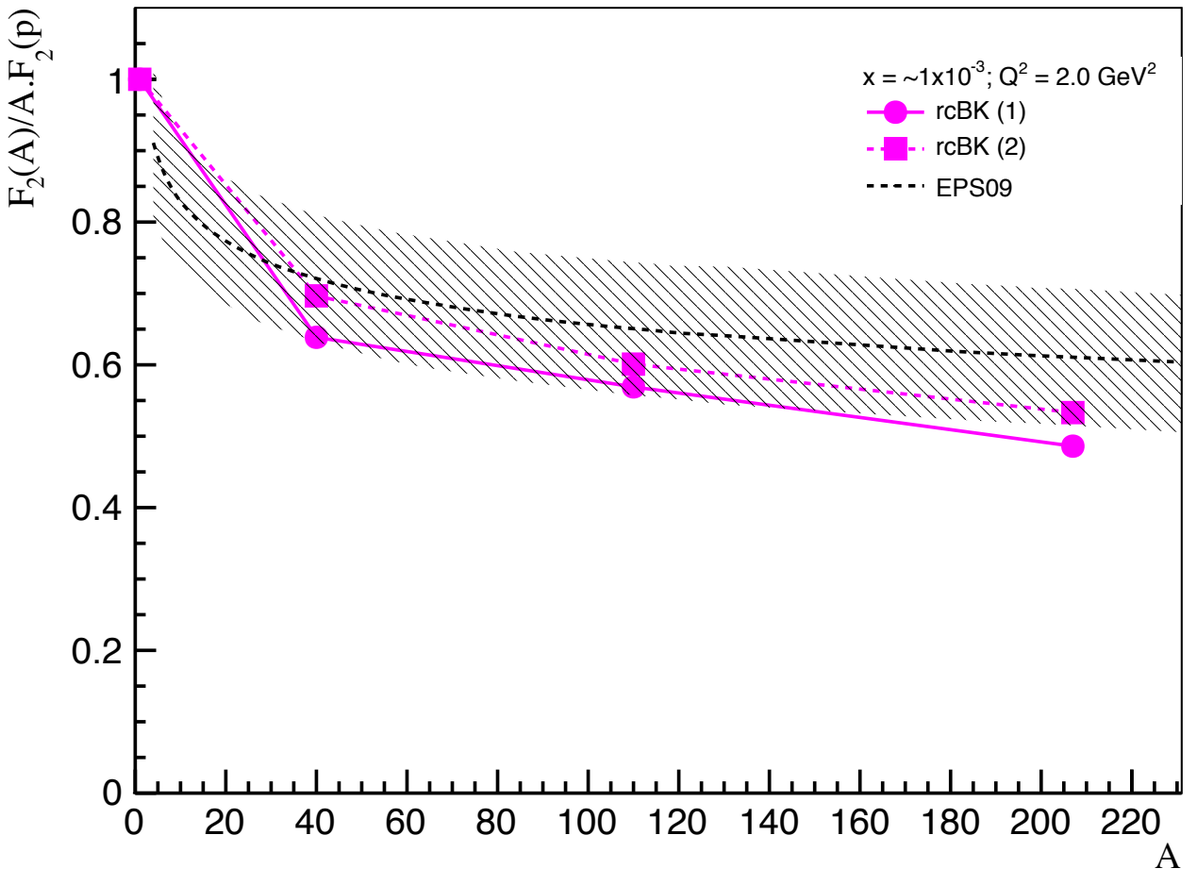
F_2 at x=10^{-3}, 10^{-4}: Q^2=2.7 GeV^2

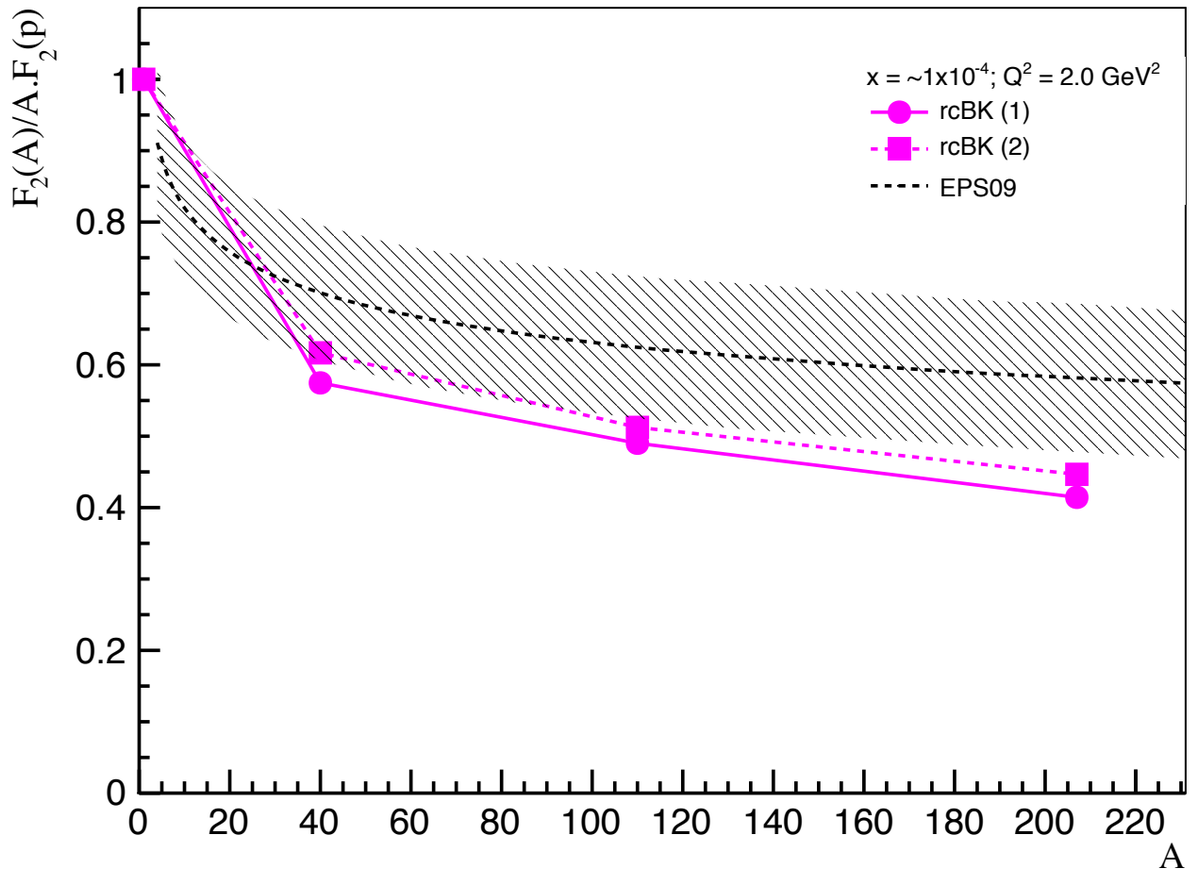




- A pretty good agreement between EPS09 and rcBK within the uncertainties.
  - ➡ EPS09 F_2 uncertainties quite well constrained by existing data

F_2 at x=10^{-3}, 10^{-4}: Q^2=2.0 GeV^2





- Still pretty good agreement between EPS09 and rcBK within the uncertainties.
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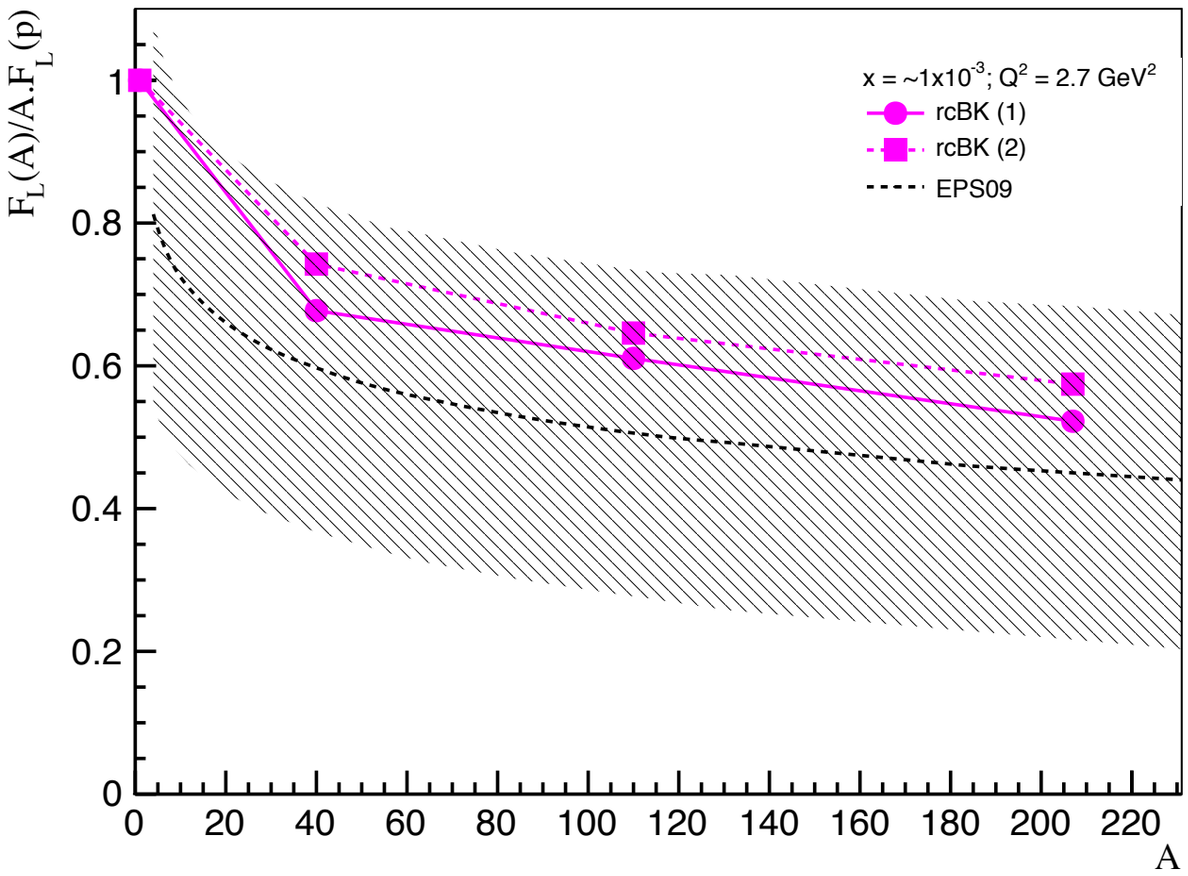
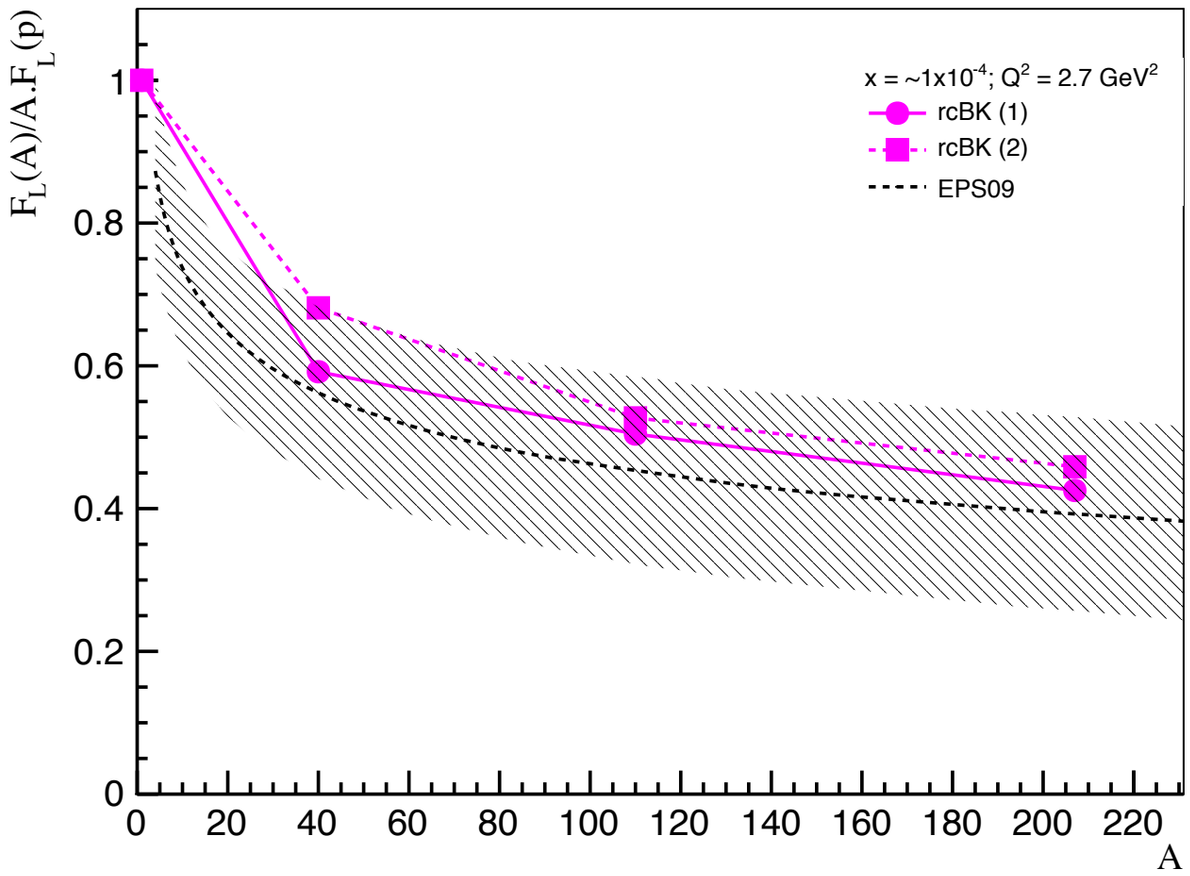
F_L at x=10^{-3}, 10^{-4}: Q^2=2.7 GeV^2





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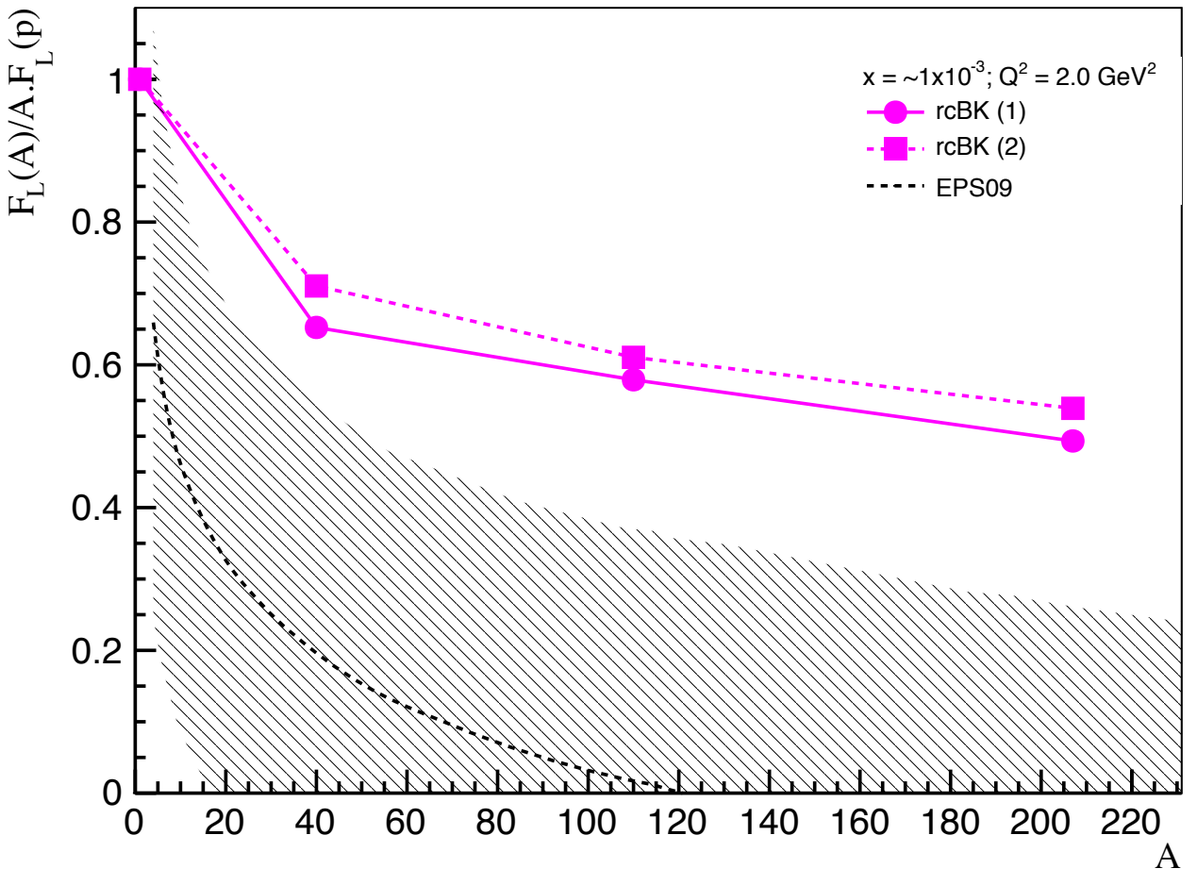
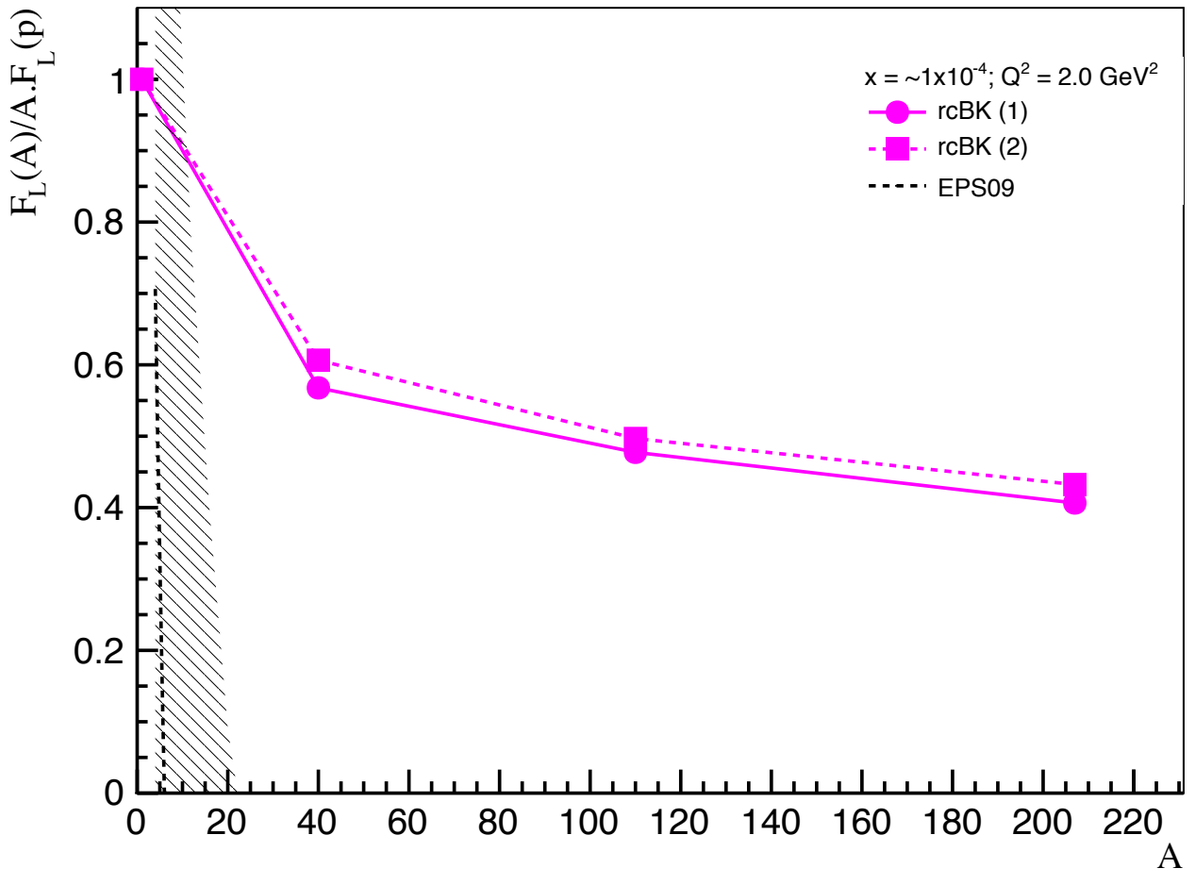
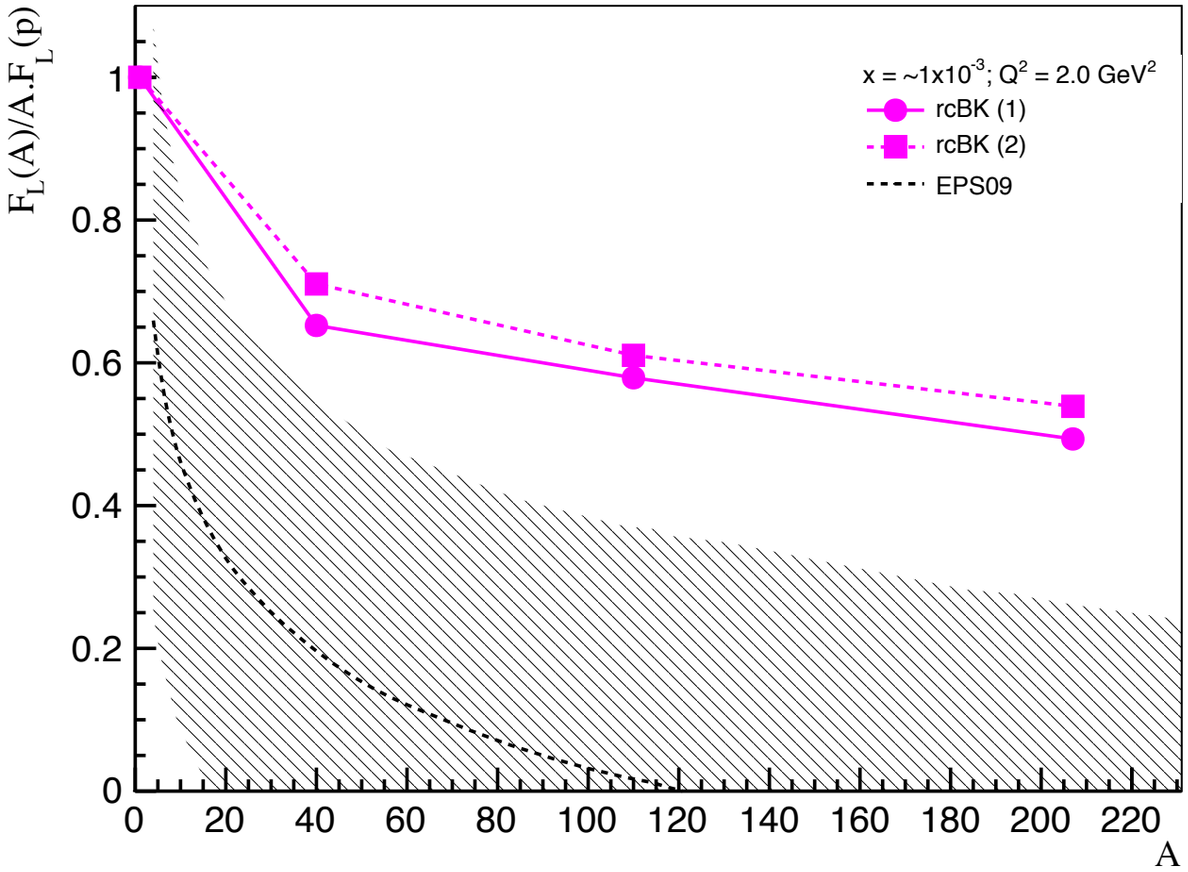
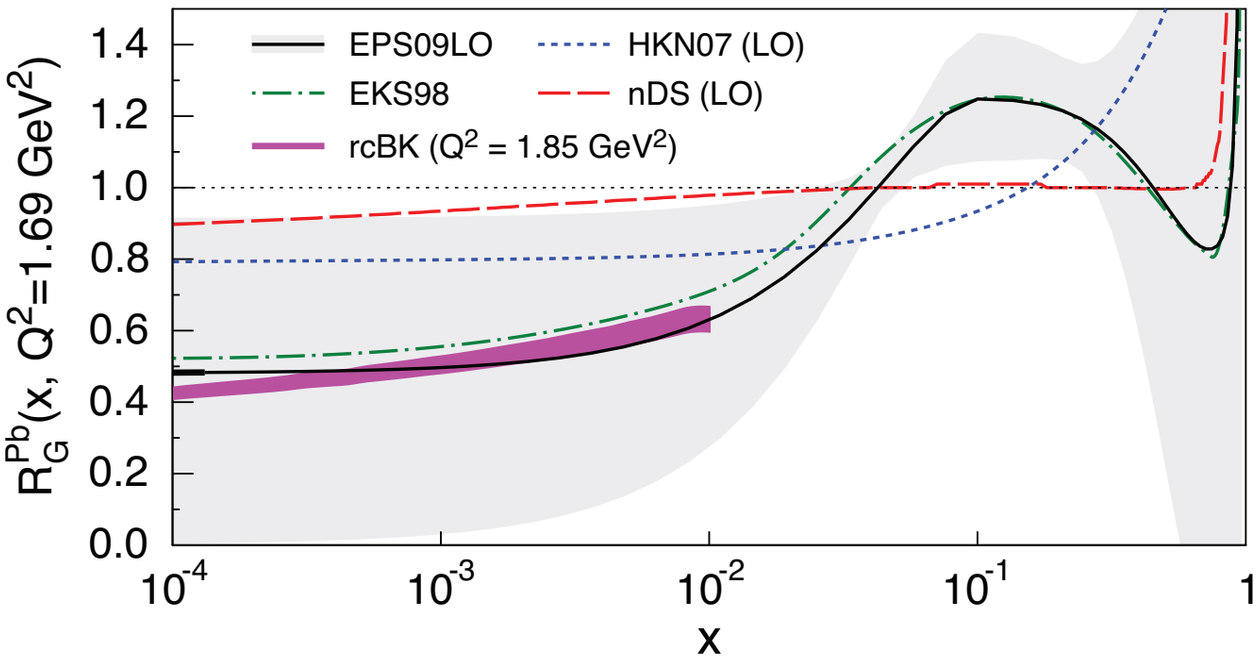




- Any agreement between EPS09 and rcBK is now well outside the uncertainties.
  - ➡ EPS09 F_2 uncertainties now less well constrained by existing data

F_L at x=10^{-3}, 10^{-4}: Q^2=2.0 GeV^2





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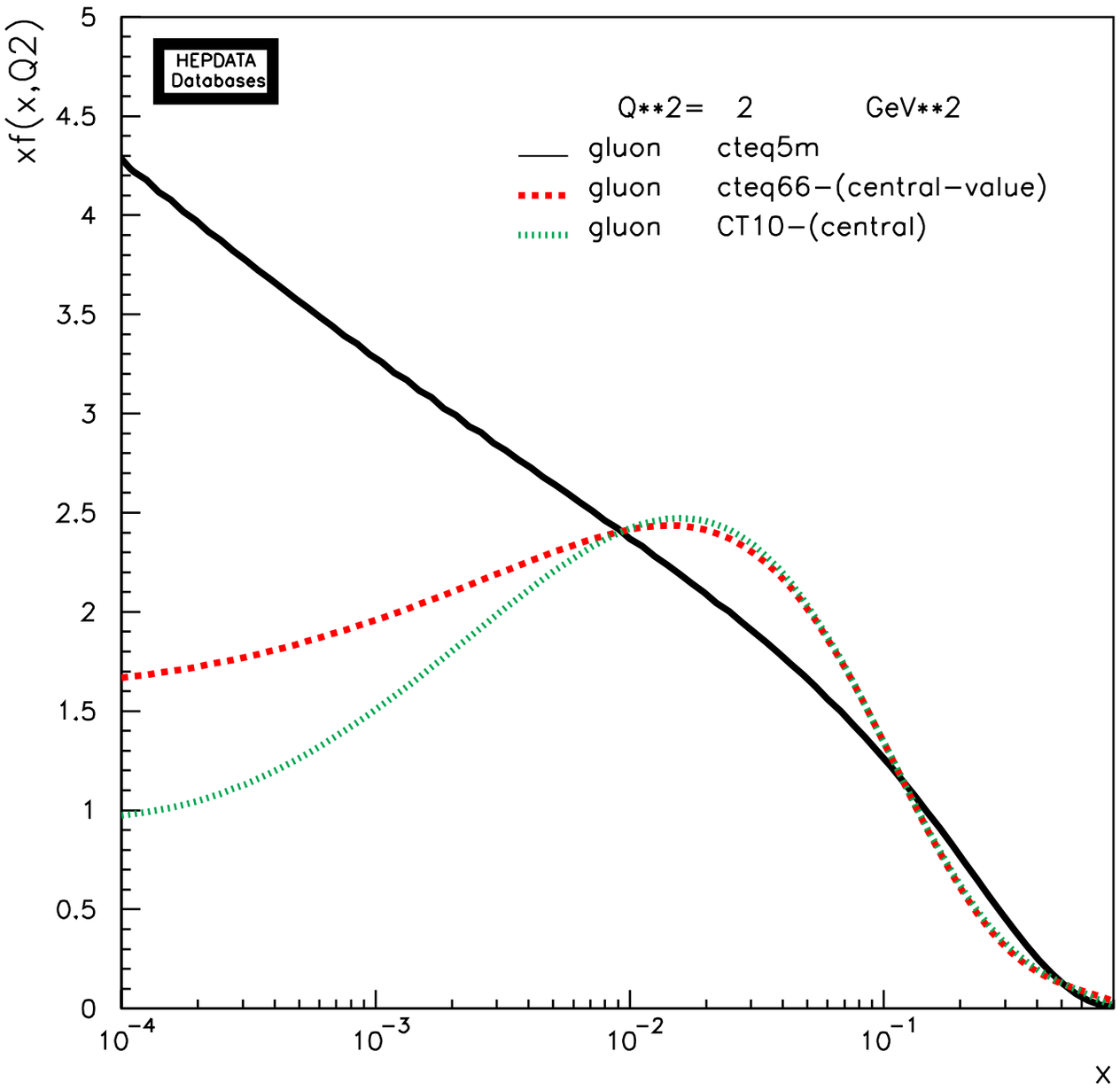
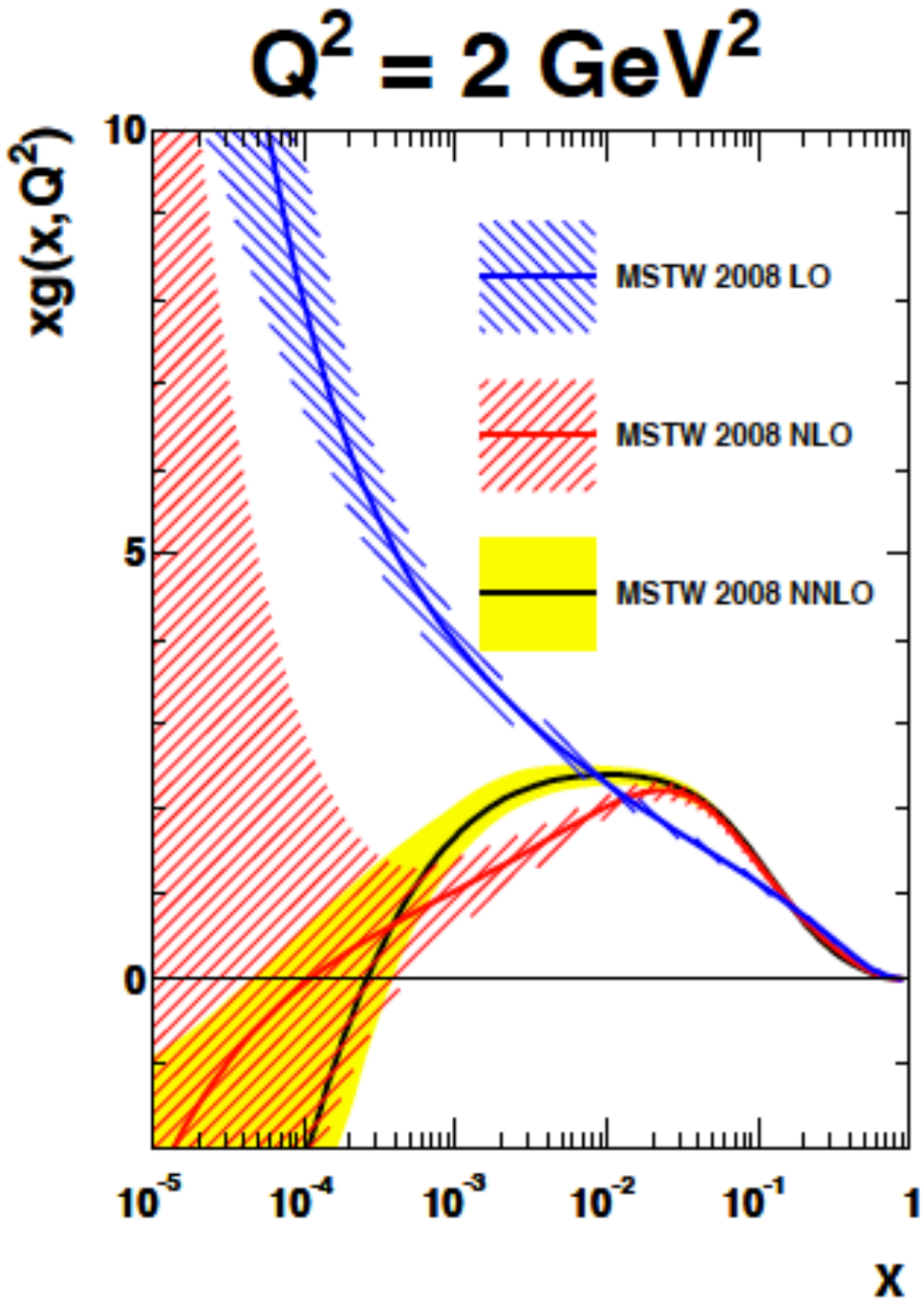
CTEQ vs MSTW





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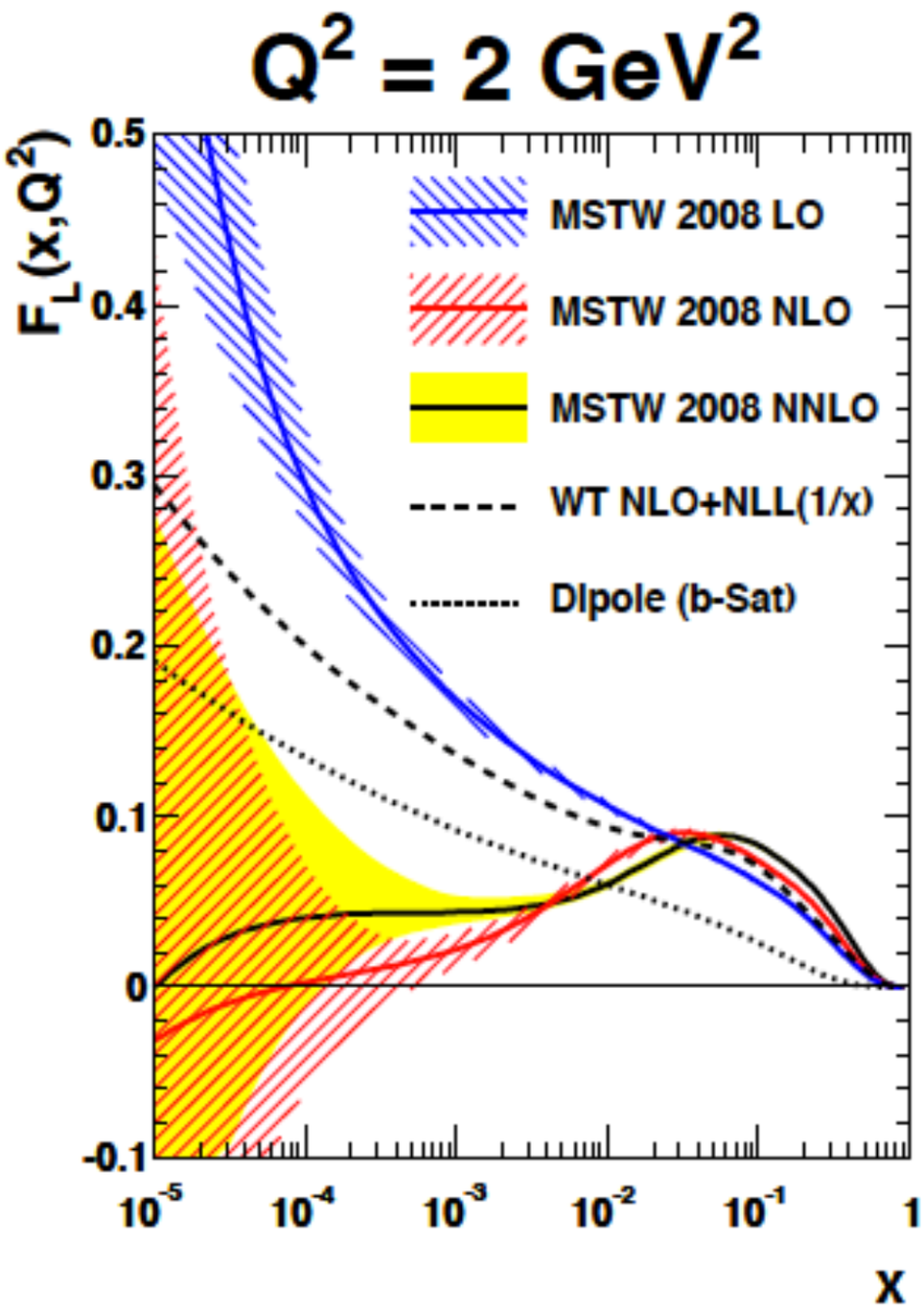
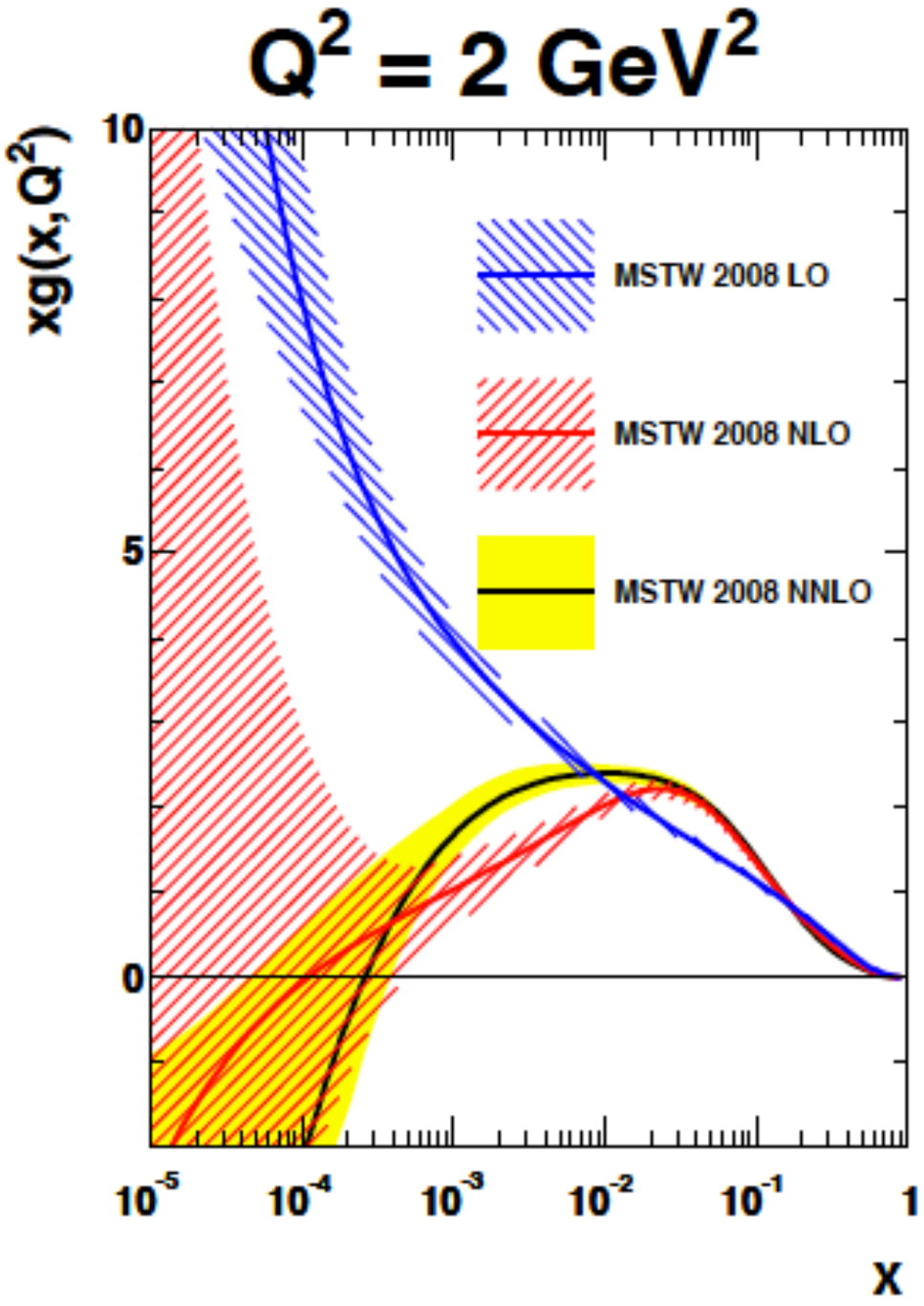

$Q^2 = 2\ GeV^2$
$F_L(x,Q^2)$
0.5
0.4
0.3
0.2
0.1
0
-0.1
MSTW 2008 LO
MSTW 2008 NLO
MSTW 2008 NNLO
WT NLO+NLL(1/x)
Dipole (b-Sat)
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
X


$Q^2 = 2\ GeV^2$
$xg(x,Q^2)$
10
5
0
MSTW 2008 LO
MSTW 2008 NLO
MSTW 2008 NNLO
10^{-5}
10^{-4}
10^{-3}
10^{-2}
10^{-1}
1
X